

UNDERGROUND STORAGE TANKS

19.01 GENERAL

This manual is intended for internal guidance only and is not intended to create a legal or moral duty. Supervisors have discretion, based upon their expertise and the particular circumstances, to deviate from this manual and to conduct additional research or receive input from experts in other areas, as needed.

19.01.01 GOALS

The intention of the Division of Highways is to find or prevent underground storage tank (UST) leaks and spills. All problems caused by leaks and spills shall be corrected.

19.01.02 JUSTIFICATION

The first and foremost justification for a comprehensive UST monitoring program is the requirements of Federal and State environmental laws. The cost of fuel loss, environmental clean-up, and property damage can make a well managed UST program very cost effective.

19.01.03 DEFINITIONS

- Anode:** Any positively charge electrode, as of an electrolytic cell, storage battery or electron tube.
- Cathode:** Any negatively charged electrode, as of an electrolytic cell, storage battery or electron tube.
- Cathodic Protection:** Reverses current in one of two ways: sacrificial anodes or impressed current.
- Corrosion:** Deterioration of metal due to a reaction. External corrosion of buried steel structures is an electro-chemical process.
- Deicing:** To add a substance known as dry ice (solid carbon dioxide) to the vapor product in a storage tank to neutralize all combustible vapors.
- Electrolyte:** A substance that dissociates into ions in solution or when fused, thereby becoming electrically conducting.

Foreign Material: Original fill, dirt, gravel, limestone chips, contaminated soil, salts And other material that could promote corrosion to the storage tank. Contact with the tank provides a mechanism for corrosion to start.

Hazardous & Solid Waste Amendments: Established a comprehensive Federal Regulatory Program for underground storage tanks.

Inert: Exhibiting no chemical activity; totally unreactive.

Inert Material: Aggregate used for backfill in the bedding quadrant, sides and top cover for the underground tank. Best material is clean sand or pea gravel. Alkaline or acidic material causes a chemical reaction.

Non-Metallic Bushings: Nylon or plastic bushing inserted in the tank's suction or vent pipes to prevent current from making connection with the piping and pumping system. This saves the sacrificial anode solely for the tank's protection.

Sacrificial Anode: A metal anode more negatively charged than steel (Galvanized Series) is electrically connected to the structure to be protected. The anode is then buried near the bottom of the tank. Anode corrodes (is sacrificed) while the tank is protected.

Underground Tank Corrosion: Caused by an electrical current leaving a metal and flowing to another portion of the metal or soil. Over a period of time, the oxygen and moisture contribute to the breakdown of the metal into its original state, an ore. Underground conditions and moisture can accelerate corrosion.

19.01.04 UST REQUIREMENTS

19.01.04.01 INSTALLED PRIOR TO DECEMBER 22, 1988

UST's in this category must have corrosive protection for tank and piping, provide spill and overflow prevention, and comply with leak detection requirements.

19.01.04.02 INSTALLED AFTER DECEMBER 22, 1988

In addition to the requirements of Section 19.01.04.01, UST's in this category must have certification of proper installation by a qualified installer.

19.01.04.03 OWNER (DOH) RESPONSIBILITY

The Division of Highways must be financially responsible for environmental cleanup, bodily injury or property damage resulting from the ownership of any UST and shall take immediate corrective action in response to leaks or spills.

Specific rules must be followed when a UST is to be temporarily or permanently removed from service.

19.01.05 REGULATORY AUTHORITY

The West Virginia Division of Natural Resources has responsibility for administering UST regulations.

19.01.06 UST PROBLEMS

The most common problems facing UST owners are lack of corrosive protection, improper installation, piping failure, spills, and overfills.

19.01.07 LEAK DETECTION MONITORING

19.01.07.01 DEADLINING FOR TESTING

Based on the age of the tank and piping installation leak detection testing must be initiated in accordance with the following schedule:

<u>AGE OF INSTALLATION</u> <u>YEARS</u>	<u>INITIATION ANNUAL TESTING</u> <u>BY DECEMBER</u>
25 and older or unknown	1989
20 – 24	1990
15 – 19	1991
10 – 14	1992
under 10	1993

Upon initiation the above tests must be continued on an annual basis until the complete installation is upgraded to meet the minimum requirements outlined in Section 19.01.04. When upgrading is complete, testing frequency may be reduced to a 5 year cycle (See Figure 19-1).

19.01.07.02 LEAK INDICATORS

The presence of one or more of the following conditions may indicate that problems exist with an UST installation:

- 1) **Petroleum vapors in nearby underground installations, i.e., basements, manholes, etc.**
- 2) **Petroleum contamination of wells.**
- 3) **Free petroleum product in the vicinity of UST System.**
- 4) **Inventory losses in excess of 130 gallons plus one percent of monthly flow.**
- 5) **Unusual system operating condition.**
- 6) **Results of leak detection monitoring and testing.**

19.01.07.03 LEAK/SPILL REPORTING AND HANDLING

The controlling field organization must take the following action when a leak/spill of product from a UST installation is discovered:

- 1) **Take immediate steps to stop and contain the leak or spill.**
- 2) **Immediate elimination of public health and safety, i.e., evacuation, provide water, etc.**
- 3) **Eliminate property damage hazard, i.e., ventilate explosive vapors, containerize free product, etc.**
- 4) **Notify Highway Services Division, Safety Section.**
- 5) **Advise the controlling District or Division of conditions.**

The responsible District/Division must respond as follows to a leak/spill from any UST in their jurisdiction:

- 1) **Establish a detailed log of events beginning with discovery for follow-up reporting (i.e., containment steps, loss quantity measurements, hazard abatement, etc.).**
- 2) **Establish limits of vertical and horizontal movement.**

Exception: Reporting of petroleum products spills of less than 25 gallons is not required if the release is immediately contained and cleaned up.

19.01.08 UST CLOSING

The closing or removal from service of any UST System shall be classified as either temporary or permanent.

19.01.08.01 TEMPORARY CLOSING

UST not used for 3 to 12 months may be temporarily closed if the following conditions are satisfied:

- 1) All lines, except the vent line, must be capped.
- 2) Continue leak detection monitoring.
- 3) Continue corrosion protection operation where applicable.
- 4) Handle discovered leaks in the same manner as for active installation.

UST's meeting the standards for new or ungraded systems may be temporarily closed for an indefinite time period if the above requirements are satisfied.

The Division of Natural Resources may grant an extension of the 12 month temporary closure limit for UST's that do not have corrosion protection. Requests for this type extension should be handled through the Maintenance Division.

19.01.08.02 PERMANENT CLOSING

When the decision is made to permanently close any UST the Division of Natural Resources must be notified through the Maintenance Division.

The permanently closed UST may be removed, or may remain in the ground and be filled with a chemically inactive solid such as sand. In either case the following conditions must be satisfied:

- 1) Tank must be emptied.
- 2) All hazardous vapors, liquids and accumulated sludge must be removed in accordance with standard safety practices.
- 3) Environmental damage must be assessed and corrective action taken if necessary.

19.01.09 REPORTING AND RECORDS

Timely reporting and accurate record keeping is mandatory for the success of our UST monitoring program.

19.01.09.01 REPORTING REQUIREMENTS

The following incidents must be reported to the Division of Natural Resources through the Maintenance Division (see Figure 19-2).

- 1) A UST Notification Form must be completed for all new UST installation.
- 2) Suspected release (leaks/spills).
- 3) Confirmed release-and planned follow-up corrective action.
- 4) Permanent closures of UST's 30 days prior to proposed suspension of operations.

19.01.09.02 RECORD KEEPING

The following records shall be maintained for each UST System at the District/Division level:

- 1) Leak detection performance, including most recent tightness test and past year's monitoring results.
- 2) Maintenance and repair records.
- 3) Two most recent corrosion protection inspection reports by a trained professional.
- 4) Records certifying that any UST System repair and/or upgrading was properly performed.
- 5) Maintain site assessment result for 3 years after permanent closure of any UST installation.

19.02 TANK REMOVAL, SAFETY, TRANSPORTATION AND DISPOSAL

19.02.01 PREPARATION OF STORAGE TANKS AND PIPING

- 1) Disconnect and abandon in place all underground products, and vent piping and electrical conduits for submerged pumps, if applicable.
- 2) Uncover tops of tanks to be removed.
- 3) Use only water as the rinsing agent for the product lines and tanks.
- 4) Disconnect check or foot valves and allow product in lines to drain back into tanks.

- 5) Flush product lines with water in the quantities as shown:

1 ½" diameter piping - 1 gallon per 10'
2" diameter piping - 2 gallons per 10'
- 6) Upon completion of flushing, all line openings should be capped.
- 7) Remove the fill (drop) tube. Disconnect the fill and product vent lines. Check level of tanks to determine low end for flushing.
- 8) Remove all above grade tank vent risers from building or remote location, including support brackets, and repair all bracket support holes in building.

19.02.02 CLEAN TANKS WITH WATER

19.02.02.01 EQUIPMENT REQUIRED

- 1) Approximate size of positive displacement pump required -- 3HP, 300 psi 7.5 to 8.5 GMP at 400 RPM. If electric, the motor should be explosion proof. If a gasoline engine is used, it must be located more than 20' from the tank opening or more than 18" above grade. The pump should include a strainer, by-pass piping, pressure regulator and pressure gauge ranging up to 300 psi.
- 2) Special nozzle to fit into a 4" fill pipe.
- 3) Pipe wand of ¾" Schedule 80 pipe to extend nozzle into tank should be made up in sections for convenient carrying and storing as well as varying overall length by using short or long center section so that the handles will be at a convenient working height. It is recommended that the nozzle section and the handle section be 4' long. The center section should be 2' long for 6' diameter tanks and 4' for 8' tanks, if under the normal 3' of cover.
- 4) Short length of Aluminum Drop Tube -- To replace the existing full length tube to enable injection of wash material over the entire tank and still have a non-sparking material in contact with the wand. Use minimum drop tube length required to insure extension into tanks.
- 5) Rinse Water Reservoir -- For this purpose use a 55 gallon drum with the top removed.
- 6) Suction Hose
- 7) Pump Discharge Hose

- 8) **Ground wire is necessary between the wand and the underground piping. The jet stream at the nozzle may build up a static charge in the wand. In order to bleed off charges, a positive connection should be made between the wand and the fill pipe. Use a number 12 multi-stranded conductor with metal strap connections to bare metal.**
- 9) **Explosive gas meter--For safety reasons, the vapors in the empty tank should be checked. The detector should be used even after the washes since the corroded surfaces and sediment could continue to release vapors for a considerable period.**
- 10) **Transfer pump to move effluent from underground tank to drums if a scavenger truck is not used.**
- 11) **One inch length of rubber bushing, and strap clamp large enough to slide on 3/4" wand.**
- 12) **Plywood 24" square with a 4" circular hole located in the center. Center the 4" opening over the fill pipe. Insert the drop tube. (The ground wire can be bonded to the fill pipe through a notch in the 4" circular plywood opening). The plywood will now remain securely in place. When the wand is inserted into the tank, the rubber bushing can be tightened with the hose clamped to hold the nozzle at the desired elevation and the operator need not hold the weight of the pipe.**
- 13) **Garden hose to bring water supply to tank area.**

19.02.02.02 CLEANING PROCEDURE

- 1) **If tank to be cleaned is manifolded to a second tank it must be isolate tank.**
- 2) **Remove product from tank.**
- 3) **Pump out tank bottom.**
- 4) **Remove full length drop tube and install short aluminum tube. Ground wire must be connected to fill pipe and plywood platform set in place before short drop tube is inserted.**
- 5) **Complete system setup.**
- 6) **Fill 55 gallon drum with clean water.**
- 7) **Insert wand fully into tank, mark wand at plywood level. Remove wand, mark points 6" and 24" below plywood mark.**

- 8) **Tighten rubber bushing at the 0" mark and insert wand into tank. Turn on pump and adjust pressure to approximately 280 psi. Rotate wand covering 360°, allowing most time in the direction of the ends of the tank. Allow two minutes at this elevation. During this step, keep wand in contact with the edge of the drop tube in a manner that will orient the nozzle tip slightly below horizontal. For example, if the operator is directing the stream toward the end of the tank (handle pointed toward that end), he should keep the wand in contact with the edge of the drop tube closest to that end. This procedure will allow the stream to "skim" along the bottom and directly impact any accumulated bottom sludge. Direct impact has been found necessary for breakup of any substantial accumulation of such sludge.**
- 9) **Raise wand and move bushing to 6" level and operate for two minutes. Rock wand back and forth as you rotate the nozzle so that the jet stream moves in a vertical plane.**
- 10) **Raise wand and move bushing to the 24" mark. Continue rocking and rotating the wand. Use up the balance of the 50 gallons at this level (about another two minutes).**
- 11) **The tank access point for pump-out should be at the far or low end of the tank. Pump-out should be done simultaneously with washing.**
- 12) **De-water tanks by pumping tank rinse water, sludge, and any traces of fuel from the tanks into a clean 55 gallon drum.**
- 13) **Test waste material in drum for determination of acceptable disposal method.**

19.02.03 REMOVAL, TRANSPORTATION AND DISPOSAL OF TANKS

Temporarily plug all tank openings, complete the excavation and remove the tanks.

In accordance with NEPA - 327 standards and all applicable regulations as required by Local, State and Federal codes, the tanks shall be gas-freed by one of the following methods:

Vapors in the tanks may be rendered inert by adding solid carbon dioxide (dry ice) in the amount of 1.5 lb. per 100 gallons of tank capacity. The dry ice should be crushed and distributed evenly over the greatest possible area to ensure rapid evaporation. Caution: Avoid skin contact with the dry ice as it may produce burns. As the dry ice vaporizes, flammable vapors will flow out of the tanks. Normal safety precautions should be observed.

After the tank(s) is verified to be gas freed (below the L.E.L.: 1.4% by volume gasoline in air, N.F.P.A.) with an explosimeter, all holes and openings should be capped or plugged. Screw boiler plugs should be used to plug any corrosion leak holes. One plug should have a 1/8" vent hole.

The tanks should then have the information shown in Figure 19-3 stenciled, or hand lettered in letters no less than 1" in height, and on at least two locations on the tank. If tank is sold, a bill of sale is to be executed (see Figure 19-4). Installer to insert his name, method used to gas free, and date tank was gas freed.

If tank is transported by Division of Highways equipment, prepare and give shipping papers to the driver as shown on Figure 19-5. In most cases it will be necessary to scrape or wire brush the tank surface to ensure adhesion of the paint.

Affix 4 VR-2 flammable symbols (see Figure 19-6) 1 to each end and 1 to each vertical side.

The tanks are now ready for disposal and should be removed from the site as soon as possible.

19.03 INSTALLATION OF FIBERGLASS STORAGE TANKS

19.03.01 GENERAL

Fiberglass underground tanks must be installed according to these instructions. Failure to follow these installation instructions will void the warranty and may result in tank failure. Proper installation of fiberglass underground tanks helps to prevent tank damage and to insure long-term corrosion-proof service. It is imperative to read, understand and follow the instructions below.

Fiberglass underground tanks require the backfill material to provide as much as 90% of the tank support under certain stress conditions. The installer must be positive he has the correct bed and backfill and follow these instructions exactly. Figures 19-7 through 19-11 show typical details of tanks and installation geometry.

19.03.02 TESTING

All tanks must be vented as tanks are designed for operation at atmospheric pressure only.

Plugs and drop tube fittings are not tightened at the plant to allow for temperature changes during shipment.

Prior to setting a tank, the installer is responsible for making an aerostatic leakage test at a pressure not exceeding 5 psi conducted for a minimum of one hour without measurable loss of pressure. A tank under pressure should not be left

unattended. Use pressure gauge with full scale of not more than 25 psi. Isolate tanks from piping when pressure testing any piping. Do not approach ends or manways of tanks that are under test.

While tank is under pressure, the entire tank, including fittings, should be wetted with a soapy solution to facilitate inspection for minor leaks which otherwise might not be evident. A garden tank-type sprayer with a solution of 1 cup of dishwashing detergent in a gallon of water is acceptable.

If tanks are dropped or impacted after initial test, retest tanks and soap the areas of impact to check for tank damage. If damage has occurred, do not attempt repairs.

19.03.03 HANDLING

A fiberglass tank is approximately ¼ the weight of a comparable steel tank, so it is easier to handle. This tank is ruggedly build and has been designed to withstand normal handling; however, the following precautions shall be taken.

19.03.03.01 CHOCKING TANKS

Tanks should not be dropped, rolled, or impacted. Chock the tanks during storage and tie them down to prevent movement by high winds. Use minimum ½" diameter nylon or hemp rope over each end of the tank attached to wooden stakes of adequate size to prevent movement.

19.03.03.02 LIFTING TANKS

Use installation lift lugs to lift tank. On 15,000 and 20,000 gallon tanks, use spreader bar to insure lift angle of at least 45° at each lift lug. Guide the tank with guidelines. Do not use chains or cables around tanks. If tanks have to be moved (do not roll tanks) place them on smooth ground free of rocks and foreign objects, and rechock. The capacity of the lifting equipment must be checked before installation.

19.03.03.03 TANK OPENINGS

Tank openings shall remain closed, but tanks shall be vented during handling and up to the time pipe connections are made to prevent the intrusion of water and/or foreign matter. All unused openings are to be permanently plugged when piping is installed, and coated with fiberglass resin.

19.03.04 BED AND BACKFILL MATERIAL

- 1) Do not allow backfill material to intermix with any excavated soil at the site. If this should occur, mechanical compaction of the backfill will be

required. Minimum particle size of 1/8" (No. 6 sieve) is critical for self-compacting backfill.

- 2) CAUTION: In freezing conditions, backfill must be dry and free of ice. Do not use other backfill materials.

19.03.04.01 GRAVEL

Standard bed and backfill material should be a naturally-rounded aggregate, clean and free-flowing, with particle size not less than 1/8" or more than 3/4" in diameter. Use this description when specifying or ordering because material is known by various names in different areas. This material is commonly called pea gravel.

19.03.04.02 STONE OR GRAVEL CRUSHING

Stone or gravel crushings with angular particle size not less than 1/8" nor more than 1/2" in diameter, washed and free-flowing, is acceptable as an alternate material. This material must meet ASTM C-33 Paragraph 9.1 requirements for quality and soundness.

19.03.05 HOLE SIZE, BURIAL DEPTH AND COVER

19.03.05.01 STABLE WALLS

Stable walls are those which normally can be made vertical from bed to grade without use of shoring or sheet piling. Hole must be large enough to allow a minimum of 24" between tanks at ribs and a minimum of 24" from ends and side of tanks to hole walls. The installer will be responsible for compliance with OSHA Construction, Safety & Health Regulation," Subpart P-Excavations, Trenching and Shoring, 1926.650 thru 1926.653.

19.03.05.02 UNSTABLE WALLS

Unstable walls are those with soils having less than 750 lbs. /sq. ft. cohesion as calculated from an unconfined compression test, or soils with an ultimate bearing capacity of less than 3,500 lbs./sq. ft. The hole must be large enough to allow a minimum of 1/2 the tank's diameter from ends and sides of tanks to hole walls.

19.03.05.03 HOLE DEPTH

Burial hole must be deep enough to allow a minimum of 12" backfill bed over the natural hole bottom or concrete support slab. Tanks should have a minimum cover depth of 3'-6".

19.03.05.04 PAD DIMENSIONS (IF REQUIRED)

A pad must be made of reinforced concrete paving and must extend at least 2' beyond tank outline in all directions, as a single slab. Provide ¾" thick expansion joint all around slab for a 3 tank system. The slab is to be 8" thick with 6" x 6" 4/4 welded wire fabric. A three tank slab will be cast with two longitudinal construction joints, keyed and doweled. Dowels are to be #4 deformed round steel bars 30" long and placed approximately 48" on center in the center of the slab. An 8 mil polyethylene barrier is to be placed over the completed backfill before pouring the slab.

19.03.05.05 MAXIMUM BURIAL DEPTH

Depth of cover for tanks of 10' or less in diameter in both traffic and no traffic conditions must not exceed 7' over tank top.

19.03.05.06 ROCK AND WATER

Where a rock ledge or uncontrollable water condition is encountered in the course of excavation, the installer will not proceed with the excavation until a determination is made as to the handling of the water and the anchorage of the tanks.

19.03.06 INSTALLATION PROCEDURE - DRY HOLE

Anchoring is required for all Division of Highways UST installations.

19.03.06.01 BED

The bed under tanks should be a minimum of 12" thick over the natural hole bottom or concrete slab, if used. The bed should be sloped between 2" and 4" toward the fill at the end of the tank unless center fill is used, and in which case the bed should be level. Form setting and the use of screeds is recommended for establishing a smooth, properly pitched bed. Place tanks in the hole on the bed after forms have been removed. Do not place tanks on timbers, beams or cradles.

19.03.06.02 HIGH WATER

Tanks, whether strapped or not, must never be left on the bed without backfill to the top of tank if there is any chance of more than 12" of water in the hole.

19.03.06.03 BACKFILLING

Use the same material backfilling as was used for bedding. At the start of backfilling, care must be taken to push backfill material completely beneath the tank bottom, between ribs and under end caps to provide the necessary support. A board or similar device should be used to force backfill under the tank, since pea gravel or stone crushings will not flow into this area (see installation drawing.) Good

compaction can be obtained by slicing the gravel with a shovel all around the perimeter of each tank. Install the first 12" in two 6" layers.

Complete backfilling to the top of the tank using 12" layers. Be sure the backfill is free of large rocks, debris or foreign materials that could damage the tank. Avoid impacting tanks during backfilling.

19.03.06.04 CONCRETE SLAB ALTERNATE

In situations involving extremely low soil bearing and adverse water conditions, a concrete slab may be used under the tanks. Install prefabricated reinforced concrete deadmen. Between the deadmen, under each tank area, construct a reinforced concrete slab with a minimum thickness of 6" reinforced with 6" x 6" #6 wire mesh.

19.03.06.05 CHECK TANK DIAMETER FOR PROPER INSTALLATION

A properly bedded tank installed with backfill meeting specifications (see Section 19.03.04 **BED AND BACKFILL MATERIAL**), will normally result in a decrease in the vertical diameter of an 8' diameter tank of approximately 1% or 1" at the fitting nearest the center of the tank. While a 2% deflection is within design tolerance, 1% is considered to be the maximum acceptable. Deflection exceeding this limit is an indication that proper compaction has not been achieved. One possibility is that the backfill aggregate may contain fines below specifications limits and additional mechanical compaction by vibration may be required for consolidation.

19.03.06.06 LEVELING TO GRADE

Excavation should be brought to grade with pea gravel *or* crushed aggregate meeting the specifications for bedding and backfilling. **Do not mix materials.**

***Caution:** Bricks or blocks used to support piping must be removed prior to filling to grade. Do not use rock, shale, debris or any excavated material for fill.*

19.03.06.07 BARRICADE

The tank area must be barricaded to prevent any vehicle travel over the tanks until the minimum cover depth has been obtained.

Berms should be installed around the perimeter of the tank hole to prevent surface water from running into the hole during construction.

19.03.07 INSTALLATION PROCEDURE - WET HOLE

Anchoring is required.

19.03.07.01 WATER LEVEL

The water level should be maintained at the lowest practical level during installation. A sump and pump, or a system of well points and pumps, is the recommended method to minimize the water level in the hole. The type of system required will depend on the water flow rate into the hole. The hole's bottom should be level, free of rocks and debris and covered with at least 12" of backfill material.

19.03.07.02 BALLAST

Place tanks in the hole, adding only enough ballast to prevent floating. The ballast level in the tanks must never exceed the water level in the hole during installation. While adding ballast, use only a lifting cable to keep tanks in position. Tanks should be free to roll slightly. The lifting cable must be carefully tended.

Caution: Do not place tanks on timbers, beams or cradles.

19.03.07.03 LEVELING TANKS

While leveling tanks, insure that the required minimum distances between tanks are maintained (see Figure 19-7 TANK INSTALLATION PLAN VIEW TYPICAL.) When anchoring tanks, place straps over the tanks at designated locations.

19.03.07.04 BACKFILLING

Distribute backfill evenly around tanks and continue the procedures outlined for dry hole installation (see Section 19/03/06 DRY HOLE INSTALLATION.)

19.03.07.05 ANCHORING

Tanks must be anchored.

19.03.07.06 HOLD-DOWN STRAPS

Use performed fiberglass hold-down straps, furnished by the tank fabricator, on top of designed ribs. Anchor points should be 5' from the centerline of 8' diameter tanks (6' for 10' diameter tanks) and aligned with designated ribs ± 1 ". Do not use straps or cables against the tank shell between the ribs. Attach hold-down straps to anchor points with 1/2" diameter 6 x 19 plow steel wire rope loops using at least two cable clamps. All straps should be tightened with turnbuckles to give a snug fit of strap to tank rib. The turnbuckle diameter is to be 1 1/2" hook type or 3/4" eye type. All steel, except stainless, will be epoxy coated.

19.03.07.07 ANCHOR POINTS

Anchor points are to be fabricated from round steel bar stock of anchor bolt grade steel, formed as shown in the drawing detail. Use 1" diameter for two tanks anchor, and 3/4" diameter for one tank or galvanized eye bolts of 1" diameter. All unprotected steel shall be epoxy coated.

19.03.07.08 DEADMAN ANCHORS

The weight of the backfill above a deadman on each side of a tank to which they are anchored provides the additional hold down force required to prevent float-out under the most adverse conditions. A table on the anchoring detail drawing shows anchor spacing and deadman length for various sizes of 8' diameter tanks. The drawing also details a method of prefabricating reinforced concrete deadmen at grade which can be lowered into the tank holes after they have cured for a minimum of 7 days.

Deadmen should be installed along the center line of anchor points, taking care to have good cross alignment $\pm 1''$ with adjacent deadman anchors. The two outer anchor points should be used for lowering deadmen into the tank hole. If the installer elects to cast deadmen in place in the hole, the same anchors should be used with equal reinforcement.

Any other substitute method will require equal horizontal area, anchor points or equal strength to the wire rope.

<u>TANK DIAMETER</u>	<u>MIN. HEIGHT</u>	<u>MIN. WIDTH</u>	<u>REBAR SIZE</u>
4'	6"	6"	3/4"
6' to 8'	12"	12"	1"
10'	12"	18"	1 1/4"

Deadmen must extend the full length of the tank on each side. Deadmen can be fabricated in two pieces per side. To determine the location of anchors - see fiberglass tank specifications for tank size.

19.03.07.09 CHANCE ANCHORS

Chance anchors can be used to anchor tanks. Size, number and type vary with soil conditions which must be determined. Attach anchors to straps with wire cable and clamp. Do not use without determining the holding strength of the actual soil for this method.

19.03.07.10 FLOAT-OUT

Tanks that are not anchored (with backfill to top of tanks ready for piping and fully ballasted with fuel) can float out should the tank hole be completely flooded with surface or ground water. Anchored tanks, fully ballasted and backfilled will not float out due to the weight of the backfill on the tank slab or deadmen.

In either case, it is essential that the tank hole be filled completely with backfill to top of the tanks. If the tank is not anchored, a minimum of 2 feet of additional fill above the tanks would be required to prevent floatation under extreme conditions. It

is, therefore, important that the necessary installation and piping above the tank be completed as quickly as possible so that this additional fill can be placed.

19.03.07.11 FILLING TANKS

Do not fill tanks until backfill is to the top of tank. Never add product or water for hold down in dry hole conditions until backfilling is completed.

19.03.08 ADDING TANK(S) TO EXISTING INSTALLATIONS

Tank(s) can be added to existing installations. It is important to remember that fiberglass tanks require good foundation support from the surrounding soil and are not self supported under fuel or overburden loads. The following guides are suggestions to reduce loads from soil or product on uncovered tanks so no damage will occur.

19.03.09 ISOLATED BURY (PREFERRED)

Install additional tank(s) in a separate hole which is a minimum of 3' from the edge of original tank installation hole. Undisturbed soil between the new excavation and the original hole must be maintained. Keep surface loads off existing tanks.

19.03.10 BURY IN SAME HOLE (ALTERNATE)

- 1) Lower the product level in existing tank(s) to less than $\frac{1}{4}$ of the tank's capacity.
- 2) Remove the surface pad, if one exists, to lower the backfill.
- 3) Excavate for new tank(s), leaving as much backfill as possible around the existing tanks.
- 4) During installation, the existing tanks must not be allowed to move. Shoring and sheeting may be required to retain the backfill.

- 5) Install new tanks as described earlier in these instructions, leaving a minimum of 24" between new tank(s) and existing tank(s).
- 6) If backfill material other than pea gravel or crushed aggregate was used for existing tank(s), shoring and sheeting should be left in place or an inert filter fabric should be installed between the old and new backfill to prevent any migration into the new granular backfill which could lead to tank failure.

19.03.11 PIPING

19.03.11.01 SCOPE OF WORK

The piping system to be installed under this section will include product and vent piping, and applicable vapor piping as shown on the plan, covered in specifications, or shown on the related piping drawings. Included are appropriate connections and appurtenances to the installed equipment in the complete system, e.g. underground tanks, dispensers and indicated vapor control or recovery equipment.

19.03.11.02 PIPING MATERIALS

Standard suction/pressure and underground vent or vapor piping shall be Underwriters Laboratory, INC. (U. L.) approved Reinforced Thermo-setting Resin Line Pipe (RIRP), molded fittings and adapters. Fill pipes and other vertical risers at tanks, vent risers, and risers under dispensers or vapor equipment shall be standard galvanized steel pipe with fittings of standard galvanized malleable iron. Galvanized malleable iron unions shall be ground joint construction with brass/brass seat, 150# for above ground and 250/300# for below ground applications. Galvanized malleable iron couplings, where required, are to be extra heavy duty. No close, continuously threaded steel pipe nipples are to be used underground. Joint of steel piping shall be made up with an approved gasoline pipe compound or teflon tape.

Flexible connectors are to be 24" long, as manufactured by Resistoflex Corporation, or equal.

Dispensers or self-contained pumps are furnished with a 1 1/2" threaded union at the inlet piping connection.

19.03.11.03 PIPING INSTALLATION

19.03.11.03.01 FIBERGLASS PIPE

Storage and handling, stringing, joining, layout and preparation for installation, cutting, tapering, bonding, curing, adapting to steel piping or flexible connectors shall be in accordance with the manufacturer's instructions and

recommendations. Installer must be familiar with and follow the manufacturer's practices and procedures unless instructed otherwise.

All unconnected pipe stubs or runs shall be protected against the intrusion of dirt or other foreign material into the piping system. Protective caps used in shipping the pipe are suitable if they are taped in place.

Where repairs are required during installation, testing or inspection, the defective portion of the piping shall be removed and replaced with new pipe and fittings. Repairs such as a sleeve type line patch over a damaged pipe, or a glass cloth and adhesive build-up over a joint or fitting, are not acceptable on new work.

When installing fill boxes or vapor adaptors, the installer should provide a minimum of 3" (maximum 4") clearance between the top of the cap and bottom of the manhole cover. The drawings call for a coupling to be installed near the top of each riser so that this clearance can be adjusted as required.

19.03.11.03.02 TRENCHING AND PIPE CHASES

Trenching width shall be sufficient to maintain clearance between pipes and side walls and of a depth sufficient to provide the proper bed, cover, and pitch of lines. The minimum cover to finish grade over product lines outside the concrete island mat area is 18". The minimum spacing between adjacent pipes is 5"; however, piping runs will not be layered. Where piping runs must cross, a 5" vertical clearance between pipes must be maintained.

19.03.11.03.03 BED AND BACKFILL MATERIAL

Bedding and backfill material shall be in accordance with Section 19.03.04 of this Manual.

19.03.11.03.04 BEDDING OF PIPE

A minimum of 6" of compacted bed, graded to give the proper slope or depth of pipe runs, must be laid in the trench before pipe runs are installed. Pipe runs should be fabricated at-grade and installed and properly spaced on the completed bed. After making necessary connections of runs and branches, and fittings which must be made up in the trench, bed material should be replaced under the piping and properly compacted.

19.03.11.03.05 GALVANIZED STEEL PIPING (GALVANIZED MALLEABLE IRON FITTINGS)

Galvanized steel piping has been selected to be used in conjunction with fiberglass piping at locations where the size of the piping, complexity of the structure, arrangement, or above-ground application precludes the use of fiberglass material.

All joints of piping shall be made up with an approved gasoline pipe compound or teflon tape. The latter is preferred. Litharge and glycerine are not approved. All unconnected pipe stubs, risers or runs shall be capped tight to prevent tampering or the intrusion of dirt. The use of filler material, such as plumber's string, in making up a pipe joint when threads are improperly cut is unacceptable. Vent risers, gasoline (or vapor) risers under dispensers, tank risers (and manifolds) shall be in accordance with the drawing details. All underground galvanized piping shall be painted with fiberglass resin.

19.03.11.03.06 FLEXIBLE CONNECTORS/SWING JOINTS

Flexible connectors are to be installed at the following points:

- 1) Tank connections to vents or vapor lines.
- 2) Between riser(s) under each dispenser and fiberglass pipe runs for either gasoline or vapor, as may be required.
- 3) Underground at base of vent risers - pipe swing joint only.
- 4) Flexible connectors will not be used for making 90° bends in the piping system; however, they may be used for some degree of misalignment.
- 5) Flexible connectors should be installed so that there is no radial stress or twist in the hose when joints are assembled.

19.03.11.03.07 VENT AND VAPOR PIPING - SLOPE OF LINES

A minimum of 1/8" per foot is required in all underground vent and vapor piping; however, the maximum available slope should be used within requirements for cover over piping and depth of tanks. Pipe cover requirements are detailed on the drawings. Piping will be installed on pre-graded, compacted bed material. No support or spacing material other than the bed and backfill will be left in contact with the piping. The method of installation shall prevent the possibility of any sags or humps which would trap the lines.

If a uniform minimum slope of 1/8" per foot in vapor lines from the pump islands to the tank results in the line being below the tank connection, a condensate trap and thief port will be installed in the line just outside the tank excavation area.

19.03.12 TANK FITTINGS, MANHOLES AND APPURTENANCES

The installer is responsible for providing the proper clearance between the tank shell and fill tubes. The installer should check the installed tank diameter at the opening into which the pump or tube is being installed and make necessary adjustments to maintain the specified clearance of 4" (maximum 5").

19.03.13 TESTING AND INSPECTION

After all lines have been installed, and before they are backfilled, lines are to be disconnected from the tanks, plugged or capped and subjected to a minimum 50 psi gauge air pressure (or as required by Local or State codes) and checked for leaks with a "soapy solution" for a minimum of 30 minutes.

After reconnection of all lines and prior to backfilling the entire system, to include tanks and all lines, lines are to be subjected to a final air test of 5 psig for a minimum of one hour without a measurable loss of pressure.

Air testing of fiberglass piping is not recommended by manufacturers unless certain safety precautions are followed. The installer should obtain the appropriate procedures from fiberglass pipe suppliers and assume responsibility for following the prescribed testing pressures. Their recommendations will include covering the pipe between joints, placing sand bags or other restraints at intervals and safety precautions for personnel working on site and/or involved in the testing.

Prior to making the high pressure test, it is recommended that the installer first apply a low pressure 5 psig leak test to insure that all adapters are securely threaded into place and that adhesive has been applied to every joint and properly cured. The low pressure leak test can be applied in a short time, thus, locating any badly made joints immediately. The line should be carefully inspected for evidence of leakage by either using a soap solution on the joints or listening for the hissing sound of escaping air. Once it has been determined that all connections are tight, the full test pressure should be applied and allowed to remain as long as specified.

19.03.14 BACKFILLING OF PIPING

After the satisfactory completion of all required testing and inspection of piping, backfilling of trenches to subgrade elevation should be completed as required for the material used.

If it becomes necessary during the course of construction to switch from the standard backfill material to an alternate, soil stabilization or filter fabric must be installed as a barrier between the two non-compatible materials.

19.03.15 MONITOR WELLS

Monitoring wells shall be installed at opposite corners of the excavation before backfilling. Perforated pipe shall be placed vertically from the bottom of the excavation 2' from the end and 2' from the side of tank. The pipe shall be 4" diameter with a single wrapping of filter fabric. The well shall be backfilled in conjunction with the tank.

All filler, vent, well tops are to be concreted around if a slab is not constructed over the tanks. See Detail for Dimensions.

19.04 INSTALLATION OF METAL STORAGE TANKS

19.04.01 METAL STORAGE TANKS

The backfill material shall be free from material that may cause damage to the tank coating.

The bottom of the excavation shall be covered with a clean sand or pea gravel (limestone not acceptable) to a depth of one foot, suitably graded and leveled.

The excavation shall extend a distance of at least one foot around the perimeter of the tank.

An air test of the tank above ground is recommended. Pressure should not exceed 5 pounds per square inch (PSIG) while a soap solution is applied to weld seams.

Before placing the tank in the excavation, all dirt clods and similar foreign matter shall be cleaned from the tanks, and areas of coating damage shall be repaired with a suitable coating.

Equipment to lift the tank shall be of adequate size to lift and lower the tank without dragging and dropping it to ensure no damage is done to the tank coating.

Tanks shall be carefully lifted and lowered by the use of cables or chains of adequate length (not less than 45 included angle) attached to the lifting lugs provided. A spreader bar should be used where necessary. Do not use chains or slings round the tank shell.

After a fuel tank has been placed in the excavation, the anode lead-wire attachment to the tank shall be checked to assure the connection has not been damaged. If there is damage, the connection must be re-established in strict accordance with manufacturer's specifications.

Anchoring requirements are the same as for fiberglass (see Section 19.03.07.05).

If the installation location has a radical variation in ground water levels, the tank bedding material should be fine gravel or pea gravel rather than sand.

Special care should be exercised when installing hold down straps to ensure that the straps are separated from the tanks by a separating pad made of an inert insulated dielectric material.

Backfill consisting of clean sand, pea gravel (limestone not acceptable), or other non-corrosive inert materials shall be placed along the bottom sides of the tank by hand and tamped to ensure that the tank is fully and evenly supported around the bottom quadrant. Original backfill should not be utilized.

19.04.02 INSTALLATION OF PIPING SYSTEM

Follow the same procedure as for Fiberglass Tanks (see Section 19.03.11.03).

19.04.03 CATHODIC PROTECTION

Metal fuel tanks are equipped with a sacrificial anode corrosion protection system. Plastic covering must be removed from anodes prior to lifting the tank into the excavation pit. Anodes automatically begin working when soil conditions are present to promote corrosion. Care must be taken when the tank is placed into the excavation to prevent anode damage. Fuel tanks equipped with the Protection Proven I, require a wire installed from the anode to the fill cap. The system to be installed in accordance with the manufacturer's recommendations and access must be provided to the system for periodic electrical checks.

19.04.04 INSTALLATION GUIDELINES

- 1) The dielectric bushing in fuel tanks shall not be removed from the unused openings.
- 2) The plugs at unused tank openings shall be removed, a pipe compound shall be added and the plugs shall be reinstalled in the unused openings.
- 3) Where air or hydrostatic testing is required after installation, it is recommended that the pressure applied shall not be in excess of 5 pounds per square inch (PSIG) as measured at the top of the tank.
- 4) The backfill shall be deposited carefully around the tank and to a depth of at least one foot over the tank to avoid damage to its coating, especially where tamping is required.
- 5) The final backfill should be clay or compactable soil.
- 6) Additional topping may consist of asphalt or concrete.
- 7) Non-sparked filler caps are required.
- 8) All caps shall be locked.

9) Color codes for fill caps:

Diesel Fuel:	Yellow
Kerosene:	Brown
Unleaded Gasoline:	White

- 10) Tanks must be filled by the distributor the day of installation in order to prevent float out. To assure that the tank is filled on the day of installation, *the distributor must be notified in advance.*
- 11) Install overfill and spill prevention equipment the same as was required for fiberglass.
- 12) Fiberglass lines may be used. If metal lines are used, they must be cathodically protected with a system separate from the tank.
- 13) Care should be taken to insure that all cathodic protection systems are installed in such a manner as to allow periodic testing of its functionality without uncovering the tank.
- 14) All other requirements, such as test wells, specified for fiberglass tank installation apply to metal tanks.

19.05 RETROFITTING EXISTING UNDERGROUND SYSTEMS

19.05.01 FUEL STORAGE TANKS

Each tank that is found sound and usable shall be fitted with an overfill prevention valve and drop tube inside the existing filler tube.

The existing top fill shall be removed and replaced with a spill container with a lockable cap.

All tanks which are not equipped with corrosion protection, i.e., fiberglass tank or cathodic protection equipped, must be retrofitted.

FOOTNOTE

As more fully set forth in Section 01.01.01, nothing in this manual is intended to create a legal or moral duty and has been created for internal guidance only.